

# Proceedings of the Iowa Academy of Science

---

Volume 31 | Annual Issue

Article 72

---

1924

## Chemical Engineering and Agriculture

Julian E. Mac Farland

*Let us know how access to this document benefits you*

Copyright ©1924 Iowa Academy of Science, Inc.

Follow this and additional works at: <https://scholarworks.uni.edu/pias>

---

### Recommended Citation

Farland, Julian E. Mac (1924) "Chemical Engineering and Agriculture," *Proceedings of the Iowa Academy of Science*, 31(1), 284-284.

Available at: <https://scholarworks.uni.edu/pias/vol31/iss1/72>

This Research is brought to you for free and open access by the Iowa Academy of Science at UNI ScholarWorks. It has been accepted for inclusion in Proceedings of the Iowa Academy of Science by an authorized editor of UNI ScholarWorks. For more information, please contact [scholarworks@uni.edu](mailto:scholarworks@uni.edu).

graphite in the first case and amorphous carbon in the second. This is in fair agreement with a calorimetric determination made by Ruff.

## CHEMICAL ENGINEERING AND AGRICULTURE

JULIAN E. MAC FARLAND

Chemical engineering is finding extensive application in two important phases of agriculture, the preparation of fertilizers to enrich the soil and the better utilization of waste agricultural products. The second phase has been studied at Iowa State College, particularly in regard to corncobs and oathulls. They contain pentosans, which can be converted to furfural, a potentially valuable product. Cobs may be destructively distilled to yield useful products including a char which can be highly activated. Cobs or oathulls may be treated with a phenol to form a black resin which can be manipulated into a valuable insulating and decorative material.

## SOLUBILITY IN AUSTENITE OF CARBON FROM CARBON AND OF CARBON FROM IRON-CARBIDE

H. L. MAXWELL AND ANSON HAYES

For the well established equilibria:

- (1)  $Fe_3C + CO_2 \rightleftharpoons 3Fe + 2CO + \Delta H_1$
- (2)  $C + CO_2 \rightleftharpoons 2CO + \Delta H_2$
- (3)  $[C]_1 + CO_2 \rightleftharpoons 2CO$
- (4)  $[C]_2 + CO_2 \rightleftharpoons 2CO$
- (5)  $[C] + CO_2 \rightleftharpoons 2CO$

Where  $[C]$  = concentration of dissolved carbon in austenite,  $[C]_1$  = saturated value of carbon from carbon,  $[C]_2$  = saturated value of carbon from iron carbide, and  $K_1, K_2, K_3, \dots$  are the gaseous equilibrium constants for these reactions. Thermodynamics demands  $K_2 = K_4$ ,  $K_2 = K_3$  and that  $K_5$  is a function of the concentration of carbon in austenite. Since iron-carbon alloys graphitize down to some 0.9% combined carbon or less,  $Fe_3C$  is metastable with respect to carbon from 720° to 1130°C. Since the heat of formation of  $Fe_3C$  is -15100 calories, it follows from the equation

$$(d/dT) (\text{Log } K) = \Delta H/RT^2$$

and from the metastability of  $Fe_3C$  that the carbon solubility line of the iron-carbon diagram lies to the left of the cementite solubility line and has a greater slope.